

APPENDIX A.2

DETAILED BEACH DELIVERY EMISSION CALCULATIONS

Table A.2.1 Comparison Between Beach Delivery and Truck Delivery					
	NO _x	CO	VOC	SO _x	PM ₁₀
Daily Emissions (lbs/day)					
Beach Delivery					
Tugs	618	186	29	1	12
Support Equipment	178	57	8	0	3
Reduction in Onsite Emissions	-144	-228	-27	-7	-5
Total =	653	15	9	-6	10
Truck Delivery	293	183	31	0	15
Net Emission Change	360	-169	-21	-6	-5
Total Emissions (lbs)					
Beach Delivery					
Tugs	6,235	1,879	288	8	122
Support Equipment	645	209	29	1	14
Reduction in Onsite Emissions*	-1,723	-2,741	-326	-80	-66
Total =	5,158	-654	-9	-71	70
Truck Delivery	2,933	1,834	308	3	150
Net Emission Change	2,225	-2,487	-317	-74	-80

Notes:

*Based on 12 days of beach delivery activity (6 barge deliveries, 2 days per delivery).

Table A.2.2
Calculation of Tug/Barge Emissions

Assumptions:

Tug Boat Main Generator Engine	7200 bhp
Tug Boat Aux Generator Engine	150 bhp
Number of tugs per barge delivery	4
Number of one way trips per day	1
Total number of round trips	6

Activity (per trip)	Distance, miles	Speed,	Time,	Engine Load		Weighted	
				Mains	Gens	Mains	Gens
Tow Loaded Barge: Travel to ESPR Site	28.79	5.18	5.56	40%	50%	29.4%	36.8%
Idle at ESPR site during unloading	0.00	0.00	2.00	10%	50%	2.6%	13.2%
Total =			7.56			32.1%	50.0%
Return Empty Barge	28.79	8.64	3.33	50%	50%		

	Pollutant				
	NOx	CO	VOC	SOx	PM10
Emissions Per Tug					
Emission Factor, Mains, g/bhp-hr(1)	3.90	1.17	0.18	0.005	0.08
Emission Factor, Gens, g/bhp-hr(1)	3.90	1.33	0.36	0.005	0.12
Full Load Em Rate, Mains, lb/hr	61.8	18.6	2.8	0.1	1.2
Full Load Em Rate, Gens, lb/hr	1.3	0.4	0.1	0.0	0.0
Max. Daily Operating Emissions - one way trip loaded, lb/day	154.6	46.6	7.2	0.2	3.0
Max. Daily Operating Emissions - one way trip empty, lb/day	105.2	31.7	4.8	0.1	2.1
Emissions Per Barge Delivery					
Max. Daily Operating Emissions - one way loaded, lb/day	618.5	186.4	28.7	0.8	12.2
Max. Daily Operating Emissions - one way empty, lb/day	420.8	126.7	19.3	0.5	8.2
Total Emissions for Barge Deliveries					
Max. Total Barge Transport Emissions, lb	6,235.4	1,878.6	288.3	7.9	122.5

Notes:

(1) Based on EPA Nonroad Engine Model Guidelines.

Equipment	Number	Engine Rating (hp)	Daily Operating Hours (hrs)	Load Factor(1) (%)	Number Operating Days (days)	Emission Factor (g/bhp)(2)					Daily Emissions (lbs/day)					Total Emissions (lbs)				
						NOx	CO	VOC	SOx	PM10	NOx	CO	VOC	SOx	PM10	NOx	CO	VOC	SOx	PM10
SPMT (HRSG deliveries)	4	469	20	50%	2	4.12	1.29	0.18	0.00	0.08	170.2	53.3	7.2	0.2	3.1	340.4	106.5	14.5	0.4	6.2
SPMT (support equipment)	2	469	20	50%	3	4.12	1.29	0.18	0.00	0.08	255.3	79.9	10.9	0.3	4.7	255.3	79.9	10.9	0.3	4.7
Dozers	2	185	2	58%	4	3.80	1.14	0.32	0.00	0.08	3.6	1.1	0.3	0.0	0.1	14.4	4.3	1.2	0.0	0.3
Ballast Pumps	6	25	4	74%	8	4.49	2.34	0.29	0.01	0.32	4.4	2.3	0.3	0.0	0.3	35.1	18.3	2.3	0.0	2.5
Total =											178.2	56.6	7.8	0.2	3.5	645.1	209.1	28.9	0.8	13.7

Notes:

- (1) For dozers and pumps, from EPA's Nonroad Engine and Vehicle Emission Study, November 1991, Table 2-05. For SPMTs, from equipment contractor.
- (2) Based on EPA Nonroad Engine Model guidelines.

Table A.2.4 Delivery Truck Emissions												
Delivery Truck Daily Emissions												
Number of Deliveries Per Day(1)	Average Round Trip Haul Distance (miles)	Vehicle Miles Traveled Per Day	Emission Factors (lbs/vmt)(1)					Daily Emissions (lbs/day)				
			NOx	CO	VOC	SOx	PM10	NOx	CO	VOC	SOx	PM10
40	165.6	6624	0.0443	0.0277	0.0047	0.0000	0.0023	293.29	183.37	30.81	0.28	15.05
Delivery Truck Total Emissions												
Number of Deliveries	Average Round Trip Haul Distance (miles)	Vehicle Miles Traveled Per Year	Emission Factors (lbs/vmt)(1)					Emissions (lbs)				
			NOx	CO	VOC	SOx	PM10	NOx	CO	VOC	SOx	PM10
400	165.6	66240.00	0.0443	0.0277	0.0047	0.0000	0.0023	2932.94	1833.70	308.09	2.75	150.47

Notes:

(1) Emission factors for delivery trucks from EMFAC2007, V2.3, LA County, model years 1965 to 2007 for heavy-heavy duty Diesel Trucks.

Table A.2.5
Beach Delivery Emission Factors

Equipment	Base Factors g/bhp (1)									Appendix A Table A3 Adjustment (2)					Adjustment (3)	Adjusted Factors (g/bhp-hr)					
	HP Cat.	Tier	BSFC lb/hp-hr	NOx	CO	VOC	SOx	PM10	Adj. Type	NOx	CO	VOC	SOx	PM10	PM10 Fuel S	BSFC	NOx	CO	VOC	SOx	PM10
SPMTs (469 HP)	300-600	2	0.367	4.3351	0.8425	0.1669	0.0050	0.1316	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	4.12	1.29	0.18	0.0049	0.08
Bulldozer (185 HP)	175-300	2	0.367	4.0000	0.7475	0.3085	0.0050	0.1316	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	3.80	1.14	0.32	0.0049	0.08
Pumps (25 HP)	25-50	2	0.408	4.7279	1.5323	0.2789	0.0056	0.3389	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.096	0.412	4.49	2.34	0.29	0.0055	0.32
Tug Main Engines (7,200 HP)	750 >	2	0.367	4.1000	0.7642	0.1669	0.0050	0.1316	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	3.90	1.17	0.18	0.0049	0.08
Tug Generators (150 HP)	100-175	2	0.408	4.1000	0.8667	0.3384	0.0056	0.1800	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.096	0.412	3.90	1.33	0.36	0.0055	0.12

Notes:

- (1) - Steady State Emission Factors from Table A2 of EPA November 2002 NR-009b Publication.
- (2) - In use adjustment factors per Table A3 EPA November 2002 NR-009b Publication.
- (3) - PM10 and SO2 adjustments due to Equation 5 and Equation 7 on pages 18 and 19, respectively, of EPA Report No. NR-009b
- (4) - Calculation uses adjusted BSFC and assumes 7.1 lbs/gallon.

Table A.2.6 Reduction in Emissions From Onsite Construction Equipment					
	NOx (lbs/day)	CO (lbs/day)	VOC (lbs/day)	SOx (lbs/day)	PM10 (lbs/day)
Approved ESPR Project					
Construction Equipment(1)=	182.50	192.80	21.30	5.40	12.20
Worker Travel(1) =	73.51	752.02	81.95	0.10	2.47
Subtotal =	256.01	944.82	103.25	5.50	14.67
Reduction in Construction Workforce Due to Use of Preassembled Components(2) =	23%	23%	23%	23%	23%
Emission Reductions Due to Workforce Change =	59.66	220.17	24.06	1.28	3.42
Emission Reduction Due to Removal of Rail Delivery(1) =	83.93	8.27	3.11	5.36	2.08
Total Emission Reductions =	143.59	228.44	27.17	6.64	5.50

Notes:

(1) From Final Staff Assessment for the El Segundo Redevelopment Project, 00-AFC-14, September 2002, Air Quality Table 5.

(2) Based on a reduction from 442 construction workers for the approved ESPR project to 339 construction workers for the Proposed ESPR project.